HELMHOLTZ ASSOCIATION

Alliance ENERGY-TRANS

DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center

ZEW Zentrum für Europäische Wirtschaftsforschung GmbH Centre for European Economic Research

A4: External Perspectives

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Germany lies in the centre of Europe and its energy and especially power supply has physical as well as financial and legal interdependencies with the surrounding states. This project has three sub-projects which aim at investigating the German-European interdependencies. This poster focuses on the first sub-project which aims at **analysing medium to long term power and money flows** to and from Germany in different European power supply scenarios.
In the other sub-projects, actual Supply & Demand Curves from European power exchanges are investigated and the effect of European market integration on Merger & Acquisition activities of firms is analysed.

Objective

Analysing medium to long term power and money flows to and from Germany with the high temporal and spatial resolution energy system model REMix (Renewable Energy Mix for sustainable Energy Supply, DLR).

Methods

1) Scenario definition (installed power generation capacities)
2) Develop a method to derive cross-border money flows from REMix model results (see box below)
3) Linear optimisation model application:
   - Power plant dispatch → marginal costs → money flows
   - Storage dispatch (and dimensioning)
   - Transmission (dimensioning and) dispatch → power flows
4) Sensitivity of parameter variations related to socio-technical scenarios

Next steps

- Further sensitivities of conventional power plant models
- Selection and parameterisation of a conventional power plant model
- Definition of socio-technical scenario descriptor variations
- Analysis of power and money flows in selected scenario variations

Ph.D. project: REMix model enhancement

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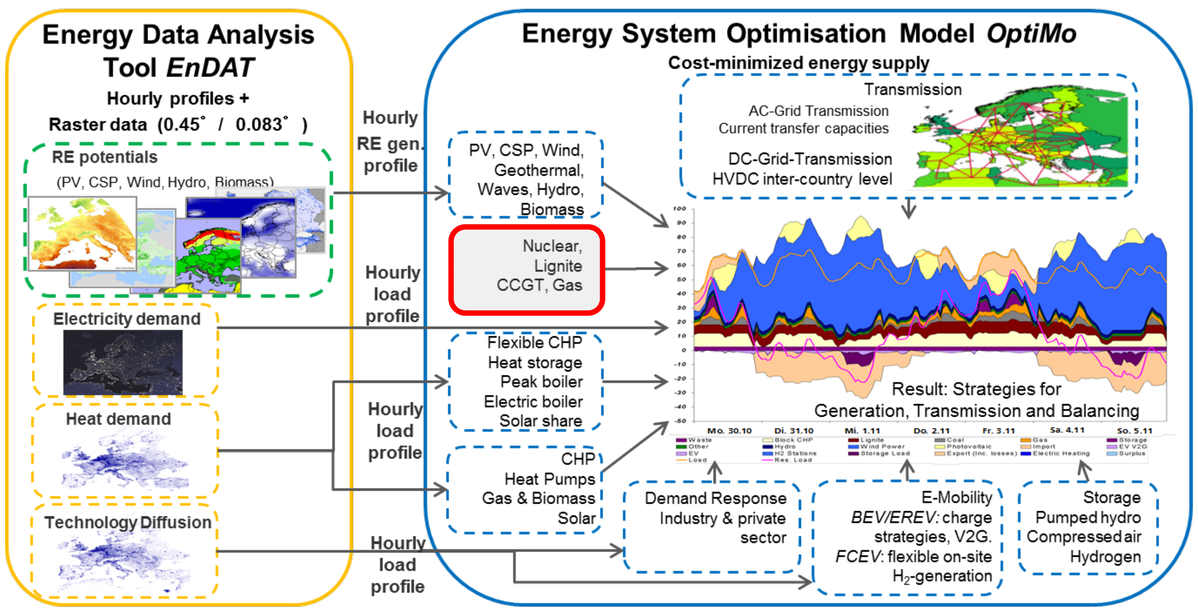
In collaboration with Dominik Schober, Oliver Woll.

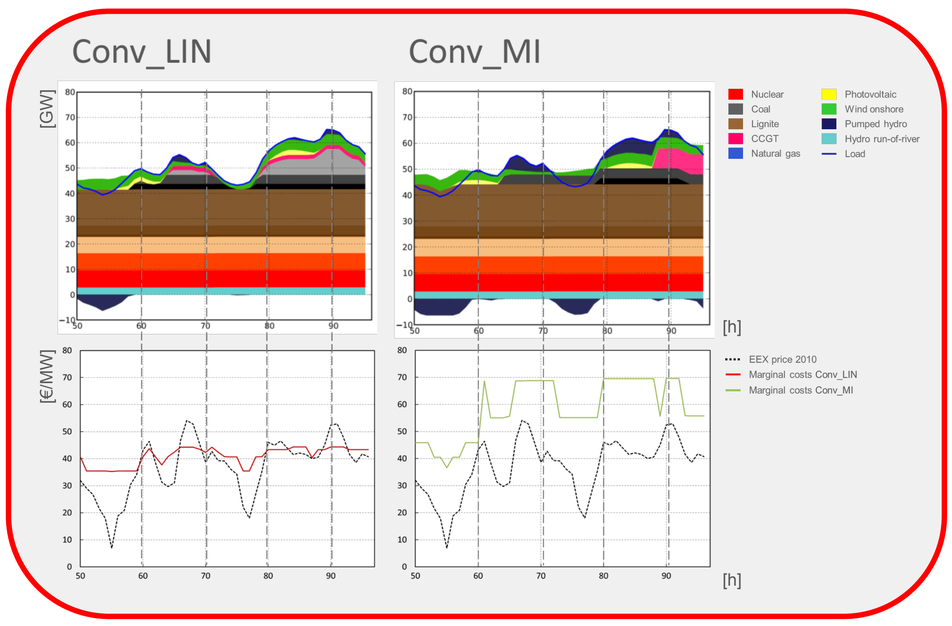
Aim: Relate marginal power cost (REMix results) to stock market prices.

Approach: Model adaptation and evaluation of marginal costs (model results). Performance index: EEX spot market prices

I. ‘Conv_MI’: mixed integer modelling → uptime, downtime, ramping constraints, ambient temperature influenced efficiency, part-load behaviour- and efficiencies for power plant units or classes
II. ‘Conv_LIN’: parameter variations with the current, linear model



Scheme of the energy system model REMix



Enhancement of the conventional power plant module

Interim results

a) Detailed model of conventional power plants ‘Conv_MI’ implemented and operational
b) Conv_LIN does not ‘see’ cost/price valleys; it operates conventional power plants continuously in order to prevent ramping costs
c) Minimum granularity of power plant classes for mixed integer modelling not yet met by Conv_MI, → overestimation of marginal costs, too large ‘cost jumps’.

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